(12) UK Patent Application (19) GB (11) 2 296 308 (13) A

(43) Date of A Publication 26.06.1996

(21) Application No 9525448.8

(22) Date of Filing 13.12.1995

(30) Priority Data
(31) 4445634 (32) 21.12.1994 (33) DE

(71) Applicant(s)
GKN Walterscheid GmbH

(Incorporated in the Federal Republic of Germany)

Haupstrasse 150, D-53797 Lohmar,
Federal Republic of Germany

(72) Inventor(s)
Felix Mikeska
Andreas Sarfert

(74) Agent and/or Address for Service
Forrester Ketley & Co
Chamberlain House, Paradise Place, BIRMINGHAM,
B3 3HP, United Kingdom

(51) INT CL[6]
F16D 3/10

(52) UK CL (Edition O)
F2U U224 U236 U282 U314 U388

(56) Documents Cited
GB 2238598 A US 5170870 A US 5078647 A
US 5054594 A

(58) Field of Search
UK CL (Edition O) F2U
INT CL[6] F16D 1/00 1/12 3/02 3/10 41/00 41/06 41/07
41/08 41/10 41/12 41/16
ON-LINE: WPI

(54) Shaft coupling

(57) A coupling comprises a sleeve (9) and a hub (11) rotatably disposed therein, first and second driving members (14, 15) in recesses (19, 20) of the hub and spring biased outwardly thereof to engage respective first and second supporting recesses (25, 26) in the sleeve (9), the first driving members (14) being adapted to transmit torque in one rotational direction and the second driving members (15) being adapted to transmit torque in the opposite rotational direction, the circumferential disposition of the first and second driving members and of the first and second supporting recesses being such that when the direction of torque transmission is reversed a certain amount of free rotational movement takes place between the hub and sleeve before torque transmission commences in the opposite direction. The free rotational movement may be used to facilitate the operation of coupling a drive shaft of an agricultural implement to the power take-off shaft of a tractor.

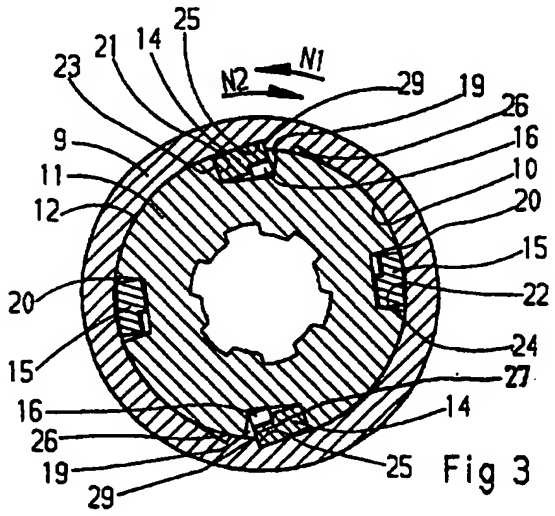

Fig 3

GB 2 296 308 A

1/2

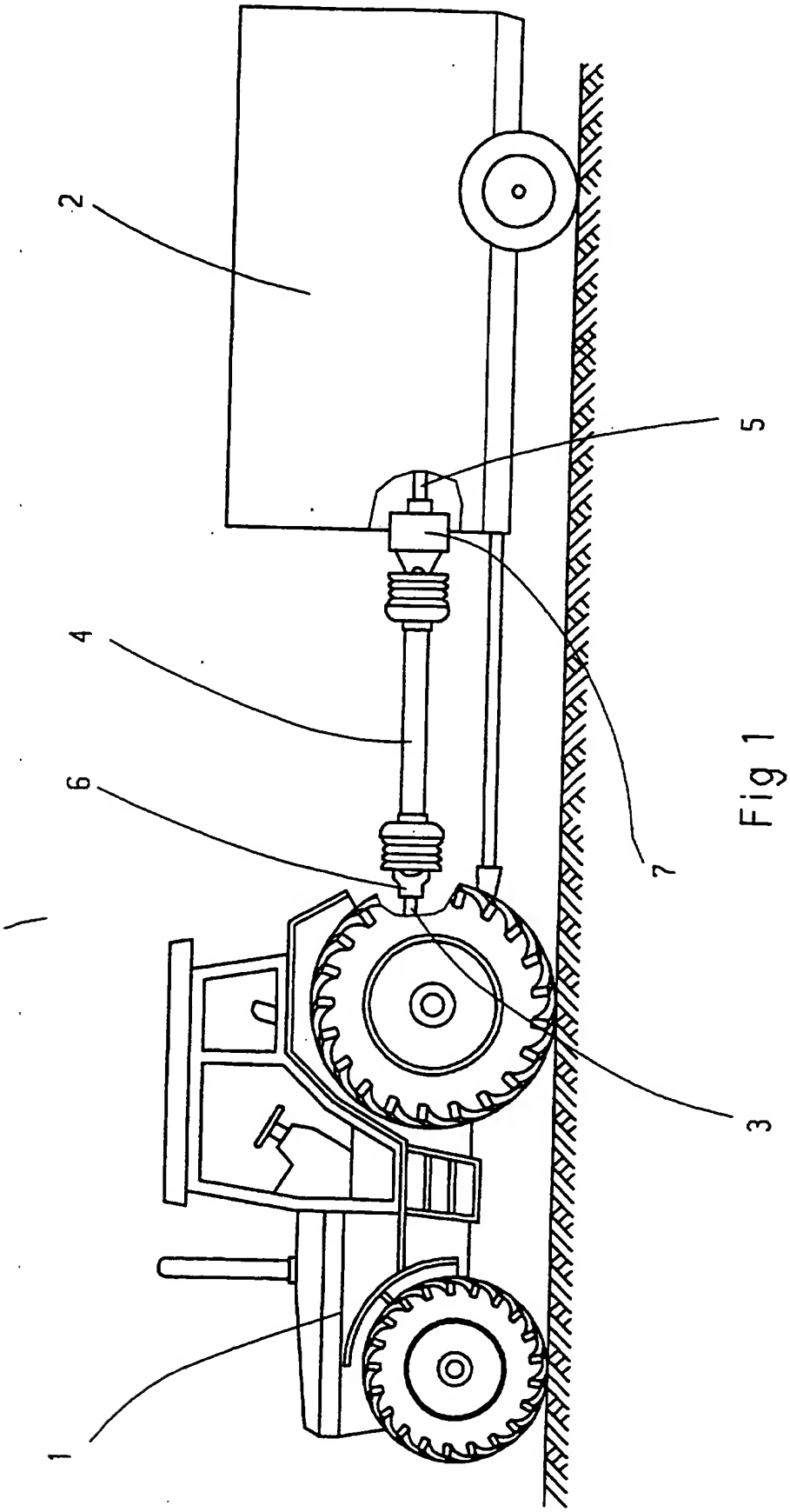

Fig 1

2/2

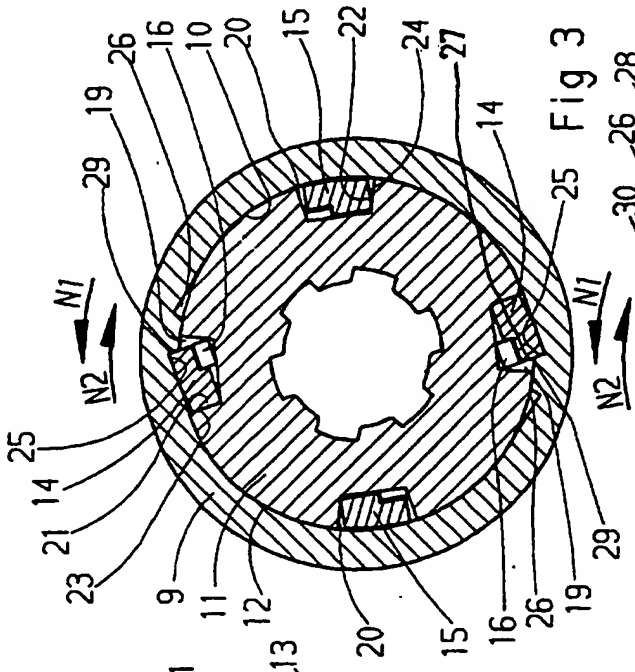

Fig 3

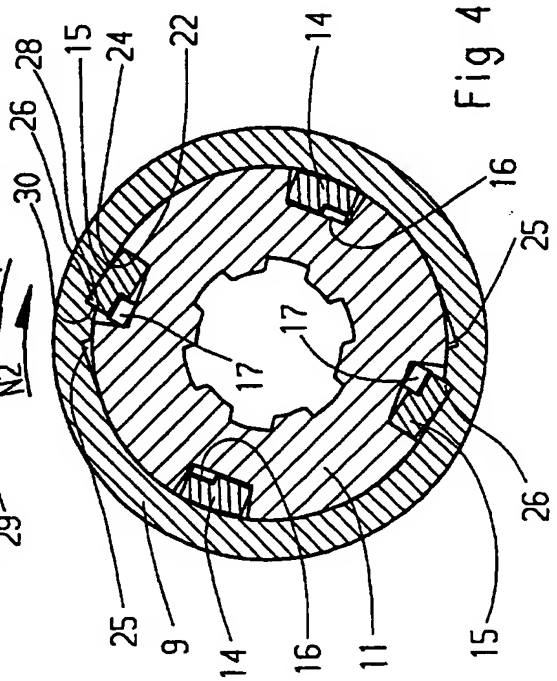

Fig 4

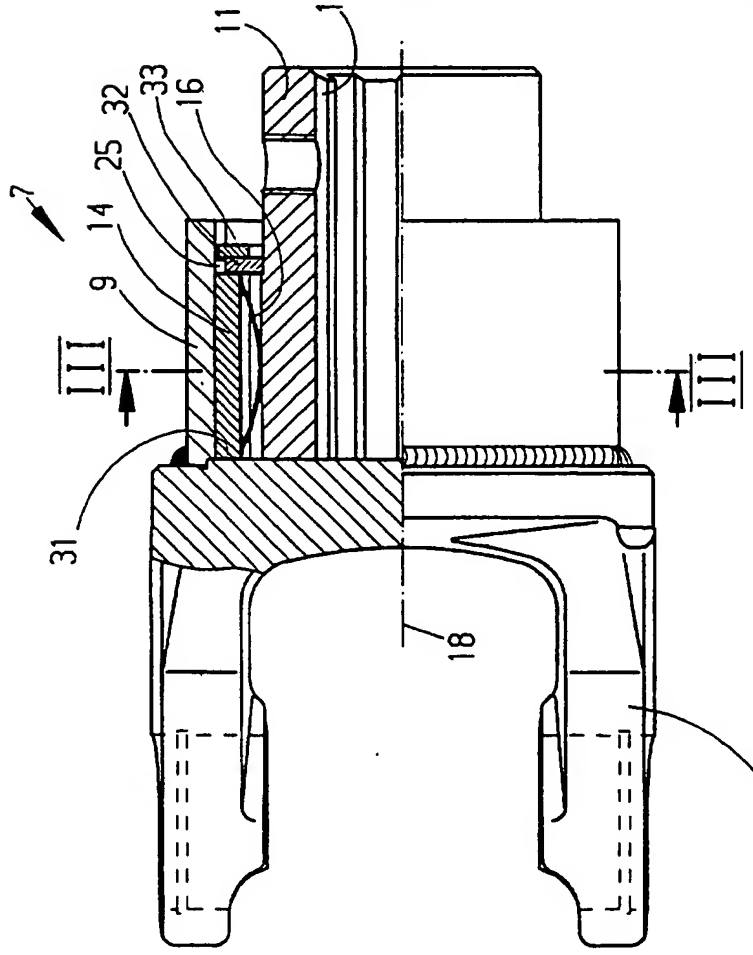

Fig 2

2296308

PATENTS ACT 1977

Title: COUPLING

Description of Invention

This invention relates to a coupling which is able to transmit torque between a coupling sleeve having a cylindrical bearing bore and a coupling hub with an outer surface which is rotatably received in the bearing bore of the sleeve for rotation about the axis of the bore, there being at least one first driving member which is received in a respective first recess of the coupling hub and is movable between a position in which it is withdrawn into the recess and a position in which it projects outwardly of the recess, the or each driving member being movable into its projecting position by spring means, and, when in such position, extending into a respective supporting recess in the bearing bore of the sleeve for torque transmission therebetween in a first rotational direction. When relative rotation occurs between the sleeve and hub in the direction opposite to the first rotational direction, the or each driving member moves back into its withdrawn position against the effect of the spring means.

Couplings of the above kind are used as free-wheeling units. In the case of an agricultural implement driven from the power take-off shaft of a tractor, the inclusion of such a free-wheeling unit in the drive line connecting the power take-off shaft to the implement enables the driven parts of the implement, which may have substantial mass, to go on rotating without any obstruction if the power take-off shaft of the tractor is stopped. Thus a drive shaft connecting the implement or parts of the power take-off shaft drive of a tractor are prevented from being damaged by the implement masses. When establishing a driving connection between an implement and the power take-off shaft of a tractor in the stationary condition, by connecting a universally jointed drive shaft associated with the implement to the tractor power take-off shaft, problems can arise if the rotating masses of the implement are relatively great or if they are held stationary by a brake, because the connection to the power take-off shaft is usually by way

of a multi-splined shaft profile and a member with a corresponding bore profile which can be slipped onto the shaft. During the connecting operation, the two profiles have to be aligned relative to one another so that they can be engaged by an axial sliding-on action. A similar problem exists if a driving connection has to be established between two implements or parts of implements.

DE-3922222-A1 (published on 24 January 1991) discloses a freewheeling coupling which has torque transmitting ratchet members for transmitting torque in two rotational directions. There are two sets of ratchet members, one per direction of rotation, only one of which is active in each case. For automatic control purposes, there are provided control rings which when the required direction of rotation changes, de-activate the ratchet members of one set while simultaneously activating those of the other set. A changeover between the directions of torque transmission can be made in a short period of time.

It is broadly the object of the present invention to provide a coupling which facilitates the establishment of a driving connection between two parts which are only able to be engaged in certain rotational positions relative to one another, by enabling some limited rotational movement to take place whilst, at the same time, ensuring that the coupling is able to transmit torque in both directions of rotation.

In accordance with the invention, a coupling of the kind herein first set forth is additionally provided with at least one second driving member extending parallel to the rotational axis and intended to transmit torque in the second, opposite, rotational direction, the coupling hub being provided with at least one second recess for receiving the respective second driving member(s) and the or each second driving member being movable between a position withdrawn into its second recess and a position projecting from same beyond the external surface of the hub member, the or each second driving member being movable into its projecting position by spring means and, when in such position, extending into a respective second supporting recess in the bearing bore of the sleeve for transmitting torque in said opposite rotational direction, the pitches

(circumferential spacings) between a first recess for a first driving member and a second recess for a second driving member, and between a first supporting recess and a second supporting recess, being different so that when torque is being transmitted in the first rotational direction only the or each first driving member is in the projecting position and when torque is being transmitted in the second rotational direction only the or each second driving member is in the projecting position, with the respective other driving member being in the withdrawn position.

The advantage of this arrangement is that, for a limited angle of rotation, the two parts, namely the coupling hub and coupling sleeve, are freely rotatable relative to one another. This enables a driving connection between components which have to be moved into a particular angular relationship with one another, e.g. a splined connection, easily to be achieved. In the case of a splined connection between a journal and a bore in a component with which it engages, the teeth and gaps therebetween may thus be aligned relative to one another to enable the connection to be established. The difference in pitch between the recesses for the first and second driving members may be selected so as to ensure that there is available a sufficiently large angle of free rotation for aligning such a splined connection having regard to the pitch of the splines. The free rotational angle may, with respect to a typical universally jointed drive shaft assembly such as is standardised for power take-off shaft drives, correspond to the spline pitch.

In the case of such an embodiment, the coupling in accordance with the invention permitting some rotational play need not be provided where it is to be used as a releasable slip-on connection to a corresponding driving journal. Instead the usual quickly disconnectable connection can be used. A coupling in accordance with the invention can be provided anywhere in the drive line to permit parts to rotate relative to one another. A coupling in accordance with the invention may thus be arranged at an end of a universally jointed drive shaft which is permanently connected or, not readily disconnectable from, the driving

journal or input shaft of an implement which is to be driven, whilst the other end of the universally jointed drive shaft may be provided with a quick-release connection to engage the power take-off shaft of a tractor. The mass of the universally jointed shaft is not sufficient to prevent rotation of same in accordance with the rotational play which is afforded by a coupling in accordance with the invention at the other (adjacent the implement) end of the shaft.

In a practical embodiment of the invention, it is proposed that the first and second recesses of the coupling hub for receiving the first and second driving members in the outer surface thereof, and the first and second supporting recesses in the bearing bore of the coupling sleeve, alternate in the circumferential direction on the respective components whereon they are provided.

The recesses in the coupling hub are preferably identical to one another. In addition, it is proposed that the first and second supporting recesses may respectively comprise first and second supporting faces which point in opposite rotational directions.

In a preferred embodiment, two driving members may be provided for each direction of rotation.

The invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 is a side view of a tractor and an implement to be driven by the tractor by means of a jointed drive shaft;

Figure 2 is a side view, half sectioned, through a coupling in accordance with the invention provided at a universal joint yoke in a shaft;

Figure 3 is a section on the line III-III of Figure 2, with the coupling being in a position to transmit torque in a first rotational direction; and

Figure 4 is a cross-section as Figure 3, but with the coupling being in a condition to transmit torque in the opposite rotational direction.

Referring firstly to Figure 1 of the drawings, this shows a tractor 1 and an implement 2 drawn thereby. The implement is driven from a power take-off shaft 3 of the tractor by way of a universally jointed drive shaft assembly 4. At

one end of the drive shaft assembly 4, adjacent the tractor, a hub 6 provides a detachable driving connection with the power take-off shaft 3 by way of inter-engaging splines provided on the shaft and in a bore of the hub, the hub being fitted onto the power take-off shaft in the direction axially thereof. At the other end of the shaft assembly 4 adjacent the implement 2, a coupling 7 provides a non-rotating connection to an input drive shaft 5 of the implement. The coupling 7 is axially fitted on to the input drive shaft 5 and has torque transmitting connection therewith, e.g. by way of inter-engaging splines, but as a rule the connection between the coupling 7 and drive shaft 5 is not released, i.e. the shaft assembly 4 remains connected to the implement even when the implement is disconnected from the tractor; the hub 6 is removed from the power take-off shaft 3 under these conditions. The multi-splined profile of the power take-off shaft 3 and of the slip-on hub 6 may be a standardised one.

In order for the hub 6 to be slipped on to the power take-off shaft 3, the spline teeth of one component have to be aligned with the gaps between the teeth of the other component. Under conditions where the rotating masses of the implement 2 are stationary and difficult to move, a coupling 7 is provided in accordance with the invention to permit some rotational freedom so that the shaft 4 and slip-on hub 6 can be rotated to align the hub 6 so that it can be fitted on to the power take-off shaft 3. Furthermore, when the implement is not being driven, the coupling 7 prevents any torsional loads from remaining in the drive shaft assembly which could complicate the operation of removing the hub 6 from the power take-off shaft 3.

The coupling 7 is shown in greater detail in Figures 2 to 4 of the drawings. In Figure 2, it is shown that the coupling 7 is connected to a universal joint yoke 8 of the universally jointed drive shaft assembly. The coupling 7 comprises a coupling sleeve 7 which is connected by a weld to the joint yoke 8 and has a cylindrical bearing bore 10 centred on rotational axis 18 of the coupling. A coupling hub 11 has a cylindrical outer surface 12 which rotatably fits within the bearing bore 10. A part of the hub 11 projects axially from the open

end of the coupling sleeve 9, facing away from the joint yoke 8. The hub 11 has a splined bore 13 whose profile corresponds to that of the power take-off shaft 3 or the input drive shaft 5 and is able to be slipped on to such shaft and secured thereto by a clamping screw engaging a radial bore in the shaft.

Figure 2 also shows that the coupling hub 11 is held in engagement with the coupling sleeve 9 by a supporting ring 32 which engages a shoulder on the hub and is retained by a securing ring 33 engaged, e.g. in an annular groove, in the bore of the sleeve 9. In the opposite axial direction, the hub 11 rests against an end face 31 of the joint yoke 8.

The hub 11 is further provided with two first driving members in the form of pivotable wedges 14 which are spaced from one another by 180° around the rotational axis 18, and two second driving members in the form of pivotable wedges 15 which are spaced from one another by 180° about the axis and by 90° relative to the first driving members 14. The driving members are thus uniformly spaced about the axis 18. The driving members 14, 15 are axially disposed between the end face 31 and the supporting ring 32.

The first driving members 14 are received in respective first recesses 19 in the outer face 12 of the coupling hub 11. The driving members are of stepped configuration in transverse section as shown in Figures 3 and 4, and for each driving member there is a leaf spring 16 disposed between the base of the first recess 19 and the underside of the driving member. Thus the driving members are spring biased for pivoting movement outwardly from the hub. One side face of each first recess 19 forms a supporting face 21 which, when the respective driving member 14 is pivoted outwardly, lies in face-to-face abutment with a supporting face 23 of the driving member.

First supporting recesses 25 are provided in the bearing bore 10 of the coupling sleeve 9, there being two such first supporting recesses spaced by 180° from one another about the axis 18. When the first driving members 14 are pivoted outwardly they are able to engage the recesses 25 and second supporting faces 29 of the first driving members 14 are able to engage supporting faces 27

provided in the respective recesses 25. Thus torque is able to be transmitted between the sleeve and hub when the coupling sleeve 9 is driven in the rotational direction N1.

The second driving members 15 are provided in respective second recesses 20 in the outer face 12 of the hub 11. Supporting faces 22 of the second recesses 20 face in the opposite circumferential direction to that of the supporting faces 21 of the first recesses 19. The orientation of the second driving members in the circumferential sense is opposite to that of the first driving members so that, for example, with reference to Figures 3 and 4 of the drawings, the first driving members 14 pivot anti-clockwise to project from their respective recesses, whilst the second driving members 15 pivot clockwise to project from their recesses. Two second supporting recesses 26 are provided in the coupling sleeve 11, for cooperation with the second driving members 15. The second supporting recesses 26 are spaced at 180° from each other but not uniformly spaced relative to the first supporting recesses 25. Thus when the first driving members 14 engage the recesses 25, the recesses 26 are circumferentially offset relative to the second driving members 15, so that the second driving members cannot transmit torque. In Figure 3, the second driving members 15 are shown in their withdrawn positions in which they lie within the confines of their recesses in the hub member and cannot transmit any torque.

When the direction of torque transmission in the coupling is reversed, to transmit torque from the universally jointed shaft through the joint yoke 8 on to the coupling sleeve 9 in the rotational direction N2 opposed to the rotational direction N1, and thence to the coupling hub 11, the coupling sleeve 9 initially moves substantially freely relative to the hub causing the first driving members 14 to be retracted into their respective recesses. When the second supporting recesses 26 reach the second driving members 15, the latter pivot outwardly into the recesses 26. In the process, their supporting faces 24 come into contact with the supporting faces 22 of the recesses 20, with their supporting faces 30 coming

into contact with the supporting faces 28 of the second supporting recesses 26. Torque may then be transmitted.

If the direction of torque transmission is again reversed, the coupling sleeve is able to move freely relative to the hub until the condition shown in Figure 3 is again reached.

The angular displacement which the coupling sleeve 9 is able to achieve relative to the coupling hub when the rotational direction changes from N1 to N2 and vice versa may be used, when the drive is stationary, to align the disconnectable couplings to enable them to be connected or disconnected, as required. The spacing of the first and second supporting recesses 25, 26 circumferentially of the sleeve 11 is arranged so that there is a sufficiently large amount of free rotation to permit the above-described connection to, or disconnection from, the power take-off shaft of a tractor to be achieved. Nevertheless, the coupling in accordance with the invention allows torque to be transmitted in both directions after such connection has been made.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

CLAIMS

1. A coupling comprising a coupling sleeve having a cylindrical bearing bore; a coupling hub with an outer surface rotatably received in the bearing bore of the sleeve for rotation about the axis of the bore; at least one first driving member received in a respective first recess of the coupling hub, and movable between a position in which it is withdrawn into the recess and a position in which it projects outwardly of the recess, the or each first driving member being movable into its projecting position by spring means and, when in such position extending into a respective first supporting recess in the bearing bore of the sleeve for torque transmission therebetween in a first rotational direction; the or each driving member being movable back into its withdrawn position against the effect of the spring means when relative rotation occurs between the sleeve and hub in the direction opposite to the first rotational direction; at least one second driving member received in a respective second recess of the coupling hub and movable between a position in which it is withdrawn into its second recess and a position projecting from same; the or each second driving member being movable into its projecting position by spring means and, when into such position, extending into a respective second supporting recess in the bearing bore of the sleeve for torque transmission therebetween in said opposite rotational direction; the circumferential spacings between a first recess for a first driving member and a second recess for a second driving member, and between a first supporting recess and a second supporting recess, being different so that when torque is transmitted in the first direction only the or each first driving member is in the projecting position and when torque is being transmitted in the opposite direction only the or each second driving member is in the projecting position, with the or each respective other driving member being in the withdrawn position.

2. A coupling according to Claim 1 wherein first and second recesses on the coupling hub for receiving first and second driving members, and first and second supporting recesses in the bearing bore of the coupling sleeve are disposed alternately on the respective component.

3. A coupling according to Claim 1 or Claim 2 wherein the first and second recesses in the coupling hub are identical to one another.

4. A coupling according to any one of the preceding claims wherein the first supporting recesses comprise first supporting faces and the second supporting recesses comprise second supporting faces which face in opposite rotational directions from the first supporting faces.

5. A coupling substantially as hereinbefore described with reference to the accompanying drawings.

6. Any novel feature or novel combination of features described herein and/or in the accompanying drawings.

Patents Act 1977 II **Examiner's report to the Comptroller under Section 17 (The Search report)**	Application number GB 9525448.8
Relevant Technical Fields (i) UK Cl (Ed.O) F2U (ii) Int Cl (Ed.6) F16D 1/00, 1/12, 3/02, 3/10, 41/00, 41/06, 41/08, 41/10, 41/12, 41/16, 41/07	Search Examiner C J DUFF Date of completion of Search 6 MARCH 1996
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1-5

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
A	GB 2238598 A	(TRW)	1
A	US 5170870	(KÄMPF)	1
A	US 5078647	(HAMPTON)	1
A	US 5054594	(KÄMPF)	1

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).